CLAIMS

What is claimed is:

1. A method for detecting an analyte in an air sample comprising the steps of:
   a. contacting said air sample with a nucleic acid/fluorophore -based sensor array comprising a substrate; and a nucleic acid labeled with a fluorophore dispersed on said substrate, said nucleic acid labeled with a fluorophore providing a characteristic optical response when subjected to excitation light energy in the presence of the analyte; and
   b. detecting the presence or absence of said analyte.

2. The method of claim 1, wherein said nucleic acid is dispersed on a plurality of internal and external surfaces within said substrate.

3. The method of claim 1, wherein said contacting further comprises drawing an air sample believed to contain said analyte into a sample chamber and exposing said nucleic acid/fluorophore based sensor array to said air sample.

4. The method of claim 1, wherein said detecting further comprises:
   a. illuminating said nucleic acid/fluorophore based sensor array with excitation light energy; and
   b. measuring an optical response produced by said nucleic acid/fluorophore based sensor array due to the presence of said analyte with a detector means.

5. The method of claim 4, further comprising identifying said analyte by employing a pattern-matching algorithm; and comparing said optical response of said nucleic acid/fluorophore based sensor array with said characteristic optical response.

6. The method of claim 4, further comprising identifying said analyte by providing spatio-temporal response patterns of said optical response; and recognizing said patterns through a method selected from the group consisting

of a template matching, neural networks, delay line neural networks, and statistical analysis.

7. The method of claim 1, wherein the air sample is suspected of containing explosive materials.

8. The method of claim 1, wherein the air sample is suspected of containing a chemical weapons agent.

9. A method of selecting a nucleic acids capable of responding to a vapor phase analyte, said method comprising:

a. contacting the nucleic acid labeled with a fluorophore with an analyte in vapor phase; and

b. measuring the emission proflile of the fluorophore in the presence and absence of the target analyte, wherein a difference in the emission profile indicates that the nucleic acid is responsive to the analyte in vapor phase.

10. The method of any of the preceding claims, wherein the nucleic acid is 1 – 3000 bases long.

11. The method of any of the preceding claims, wherein the nucleic acid is 10 – 500 bases long.

12. The method of any of the preceding claims, wherein the nucleic acid is 15 – 24 bases long.

13. The method of any of the preceding claims, wherein the fluorophore is attached to the 3' region or a 5' region of the nucleic acid.

14. The method of any of the preceding claims, where the nucleic acid is internally labeled with the fluorophore.

15. The method of any of the preceding claims, wherein the fluorophore is an applied die.

16. The method of claim 15, wherein the applied dye is YO-PRO or OliGreen.

17. The method of any of the preceding claims, wherein the substrate is a silk screen.

18. The method of any of the preceding claims, wherein the substrate is glass.

19. A sensing system for detecting and identifying a volatile compound in an air sample comprising:

a. a nucleic acid/fluorophore based sensor array comprising a plurality of nucleic acids;

b. a fluorophore attached to said nucleic acids;

c. a plurality of substrates wherein said nucleic acids are attached to;

d. a substrate support;

e. an excitation light source array comprising a plurality of light sources optically coupled to said sensor elements;

f. a detector array comprising a plurality of detectors optically coupled to said sensor elements;

g. a sample chamber for housing said sensor elements, said light source array, said detector array;

h. a sampling means enclosed in said chamber for drawing said ambient air into said chamber for contact with said nucleic acid/fluorophore based sensor array for a controlled exposure time;

i. a controller means in electrical communication with said light sources, said detectors, and said sampling means, said controller means electrically coordinating and switching said sampling means with said light sources and said detectors for sampling said ambient air, measuring optical responses of said nucleic acid/fluorophore based sensor arrays to said ambient air sample, and detecting said volatile compound; and

j. an analyte identification algorithm for comparing said measured sensor optical responses to characteristic optical responses of said sensors to target analytes and identifying said analyte in said air sample.

20. A sensing system for intelligent detecting and identifying an analyte in an air sample comprising:

a. a nucleic acid/fluorophore based sensor array comprising a plurality of nucleic acids attached to a fluorophore;

b. a detector array comprising a plurality of detectors in communication with said nucleic acid/fluorophore based sensor array;

c. a sampling chamber for housing said nucleic acid/fluorophore based sensor array and said detector array;

d. a sampling means enclosed in said chamber for drawing said ambient air into said chamber for contact with said nucleic acid/fluorophore based sensor array for a controlled exposure time;

e. a microcontroller in communication with said sampling means and said detector array, said controller means coordinating and switching said sampling means and said detector array for sampling said ambient air, measuring responses of said sensors to said air sample, detecting said analyte, and reporting an analyte detection result;

f. a sampling algorithm for directing said microcontroller; and

g. an analyte identification algorithm in communication with said sampling algorithm and said microcontroller, said identification algorithm comparing said measured sensor optical responses before and after exposure to the analyte to characteristic responses of said sensors to analytes and identifying said analyte in said air sample.

21. The sensing system of claim 20, wherein said identification algorithm comprises a response report comparing a spatio-temporal pattern of said measured optical responses to a spatio-temporal pattern of said characteristic responses; and an identification report selected from the group consisting of a pattern match, a delay line neural network match, and a neuronal network match.

22. The sensing system of claim 20, wherein the sensing system is attached to a shipping container.

23. The sensing system of claim 20, wherein the sensing system is attached to an x-ray screening machine.

24. The sensing system of claim 20, wherein the sensing system is remotely controllable.

25. The sensing system of claim 20, wherein the sensing system is incorporated into a hand-held device.

26. A sensor array system for remote characterization of a gaseous or vapor sample, comprising:

a. a plurality of sensors, wherein at least one sensor comprises nucleic acid/fluorophore combination comprising a plurality of nucleic acids attached to a fluorophore, wherein the plurality of sensors provide a detectable signal when contacted by an analyte;

b. a measuring apparatus, in communication with plurality of sensors capable of measuring the detectable signal;

c. a transmitting device, in communication with the measuring apparatus for transmitting information corresponding to the detectable signal to a remote location via the Internet, fiber optic cable, and/or an air-wave frequency; and a computer comprising a resident algorithm capable of characterizing the analyte.

27. The sensor array system according to claim 23, wherein the sensor system comprises a plurality of measuring apparatuses in communication with the transmitting device.